CLAIMS

What is claimed is:

1. A system for plasma processing of a workpiece, the system comprising:

a power generator assembly for exciting gas into a plasma;

a process chamber for processing the workpiece placed therein;

a plasma tube for delivering plasma exhaust from said plasma tube into said process chamber;

a supplemental ion source, located proximate said process chamber;

said supplemental ion source, when activated, thereby enhancing the ion content of said plasma exhaust;

a baffle plate assembly, disposed between said plasma tube and the workpiece, in said process chamber; and

isolation means for shielding the workpiece from electric field potentials in a sheath created by activation of said supplemental ion source.

2. The system of claim 1, wherein said isolation means further comprises:

said baffle plate assembly being interposed between a primary plasma discharge and the workpiece, said primary plasma discharge resulting from activating said supplemental ion source.

3. The system of claim 2, wherein the workpiece is mounted upon pins located within said process chamber.

4. The system of claim 1, wherein said baffle plate assembly further comprises:

an upper baffle plate having a first plurality of holes formed therethrough; and

a lower baffle plate having a second plurality of holes formed therethrough, said lower baffle plate being separated from said upper baffle plate by an interior plenum;

said second plurality of holes each having a first diameter at one end thereof and a second diameter at the opposite end thereof, wherein said first diameter is larger than said second diameter.

5. The system of claim 4, wherein:

said second plurality of holes define inwardly tapering inner surfaces within said lower baffle plate, beginning at said first diameter and tapering inwardly to said second diameter.

6. The system of claim 5, wherein:

said second plurality of holes comprise a frustoconical section and a cylindrical section.

7. The system of claim 4, further comprising:

a plurality of channels, running through said lower baffle plate, said plurality of channels capable of containing a liquid coolant circulating therethrough.

8. The system of claim 4, wherein said upper baffle plate comprises one of quartz, sapphire, ceramic or sapphire-coated quartz.

9. The system of claim 4, wherein said lower baffle plate is comprised of anodized aluminum.

10. The system of claim 4, further comprising:

an impingement disk, disposed atop said upper baffle plate, said impingement disk allowing a plasma discharge to impinge thereupon and be directed through said first plurality of holes.

11. A baffle plate assembly for a plasma processing system, comprising:

an upper baffle plate having a first plurality of holes formed therethrough; and

a lower baffle plate having a second plurality of holes formed therethrough, said lower baffle plate being separated from said upper baffle plate by an interior plenum;

said second plurality of holes each having a first diameter at one thereof and a second diameter at the opposite end thereof, wherein said first diameter is larger than said second diameter.

12. The baffle plate assembly of claim 11, wherein:

said second plurality of holes define inwardly tapering inner surfaces within said lower baffle plate, beginning at said first diameter and tapering inwardly to said second diameter.

13. The baffle plate assembly of claim 12, wherein:

said second plurality of holes comprise a frustoconical section and a cylindrical section.

14. The baffle plate assembly of claim 11, further comprising:

a plurality of channels, running through said lower baffle plate, said plurality of channels capable of containing a liquid coolant circulating therethrough.

15. The baffle plate assembly of claim 11, wherein said upper baffle plate comprises one of quartz, sapphire, ceramic or sapphire-coated quartz.

16. The baffle plate assembly of claim 11, wherein said lower baffle plate is comprised of a conductive material.

17. The baffle plate assembly of claim 16, wherein said conductive material is anodized aluminum and said lower baffle plate is grounded.

18. The baffle plate assembly of claim 11, wherein said first plurality of holes and said second plurality of holes are aligned with one another.

19. The baffle plate assembly of claim 11, further comprising:

an impingement disk, disposed atop said upper baffle plate, said impingement disk allowing a plasma discharge to impinge thereupon and be directed through said first plurality of holes.

20. The baffle plate assembly of claim 14, wherein said plurality of channels run in a generally V-shaped configuration through said lower baffle plate.

21. A method for creating and transporting low-energy ions for use in plasma processing of a semiconductor wafer, the method comprising:

generating plasma from a gas species to produce a plasma exhaust for introduction into a processing chamber containing the wafer;

enhancing the ion content of said plasma exhaust by activating a supplemental ion source as said plasma is introduced into said processing chamber, thereby creating a primary plasma discharge therein;

directing said primary plasma discharge into a baffle plate assembly, thereby creating a secondary plasma discharge exiting said baffle plate assembly; and

reducing the strength of an electric field exerted on ions contained in said secondary plasma discharge, said electric field resulting from activating said supplemental ion source;

wherein said reducing the strength of an electric field exerted on ions contained in said secondary plasma causes said ions to bombard the wafer at an energy insufficient to cause damage to semiconductor devices formed on the wafer.

22. The method of claim 21, wherein said reducing the strength of an electric field exerted on ions contained in said secondary plasma discharge further comprises:

locating said supplemental ion source so as to have said baffle plate assembly disposed between said primary plasma discharge and the wafer.

23. The method of claim 22, further comprising:

mounting the semiconductor wafer on pins disposed within said processing chamber.

24. The method of claim 21, further comprising:

configuring said baffle plate assembly so as to cause said secondary plasma discharge to be shaped in substantially a micro-jet formation.

25. The method of claim 24, wherein:

said baffle plate assembly includes an upper baffle plate and a lower baffle plate;

with said lower baffle plate further having a plurality of chamfered holes located therethrough.

26. The method of claim 25, wherein said chamfered holes in said lower baffle plate comprise a frustoconical section and a cylindrical section.

27. The method of claim 25, wherein said upper and lower baffle plates isolate the wafer from a high-energy capacitive sheath created by said primary plasma discharge.

28. The method of claim 25, wherein said plurality of chamfered holes are aligned with a plurality of holes in said upper baffle plate.

29. The method of claim 25, further comprising:

creating micro-jets through said plurality of chamfered holes in said lower baffle plate from said supplemental ion source in a manner such that low-energy ions are uniformly transported to the semiconductor wafer.

30. The method of claim 25, wherein said upper baffle plate comprises one of quartz, sapphire, ceramic or sapphire-coated quartz.

31. The method of claim 25, wherein said lower baffle plate is comprised of a conductive material.

32. The method of claim 31, wherein said conductive material is anodized aluminum and said lower baffle plate is grounded.